TAINTER GATE CHAIN REPLACEMENT
LOWER SAINT ANTHONY FALLS
SECTION C - CHAIN FABRICATION

Par. No.	Description	Page No.
PART 1 -	GENERAL	C-1
1.1	SCOPE	C-1
1.2	DELIVERY	C-1
1.3	APPLICABLE PUBLICATIONS	C-1
1.4	SUBMITTALS	C-2
1.5	QUALITY CONTROL/QUALITY ASSURANCE	C-4
1.6	MEASUREMENT AND PAYMENT	C-7
1.7	BIDDING SCHEDULE ITEMS	C-7
PART 2 -	PRODUCTS	C-7
2.1	METALS	C-7
PART 3 -	EXECUTION	C-8
3.1	WORKMANSHIP	C-8
3.2	FABRICATION	C-8
3.3	MACHINE WORK	C-8
3.4	CLEANING OF STEEL	C-9
3.5	ASSEMBLY	C-9
3.6	PREPARATION FOR SHIPPING	C-9

SECTION C - CHAIN FABRICATION

PART 1 - GENERAL

1.1 SCOPE. This section specifies roller chain fabrication requirements as follows:

(1) fabricate and furnish chain components as shown on the contract drawings in the quantities specified on the bill of materials.

(2) Furnish spare chain parts as indicated on the contract drawings in the quantities specified on the bill of materials.

(3) Perform specified quality control testing and inspection. Furnish specified testing equipment and assist the Government's inspector.

(4) Assemble the chain in lengths as shown on the contract drawings.

(5) Deliver the chain assemblies to the designated delivery site and unload the chain assemblies there.

The new roller chain will replace existing equivalent lengths of similar but corroded roller chain. The roller chain furnished under this contract will be installed by others at the Lower Saint Anthony Falls Lock and Dam site. The context for the installation and use of the roller chain is illustrated by the reference drawings. The roller chain connects between the tainter gate hoisting machinery up on the service bridge and the reused lower portion of link chain attached to the tainter gates down below.

1.2 DELIVERY. The roller chains and spare parts shall be delivered to the following location:

Lower Saint Anthony Falls Lock and Dam
1 Portland Avenue
Minneapolis, MN 54401-2528
Point of Contact: Mr. Meers (Phone 612-332-3660)

The Contractor will be responsible to unload the chains from the delivery trucks at the Delivery Site. The Contractor shall provide notification of the delivery date(s) at least seven days prior to each scheduled delivery date. Items shall be delivered, unloaded and positioned onsite for storage where and as directed by the Contracting Officer's representative.

1.2.1 Completion Dates. Delivery shall be no later than **180** calendar days after date of award.

1.3 APPLICABLE PUBLICATIONS. The following publications form a part of this specification to the extent referenced.

American National Standards Institute, Inc. (ANSI).

B46.1-85. Surface Texture (Surface Roughness, Waviness, and Lay).

American Society for Nondestructive Testing Inc. (ASNT).

SNT-TC-1A Recommended Practice No. SNT-TC-1A 2001

American Society For Testing And Materials (ASTM).

A 29-93A. Steel Bars, Carbon and Alloy, Hot-Wrought and Cold Finished.

A 276-95. Stainless Steel Bars and Shapes.

A 564-95 Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.

A 578-92 Standard Specification for Straight-Beam Ultrasonic Examination of Plain and Clad Steel Plates for Special Applications.

B 505-95 Copper-Base Alloy Continuous Castings.

E 114-95 Ultrasonic Pulse-Echo Straight-Beam Examination by the Contact Method

1.4 SUBMITTALS. Within 10 calendar days after the date of award, the Contractor shall submit to the Contracting Officer for review and approval a submittal control document (ENG Form 4288) listing and scheduling all items required to be furnished for review and approval action by the Government. A sample and a blank ENG Form 4288 are included as attachments to this Section. The document shall list such items as shop drawings and manufacturer's literature, certificates of compliance, material samples and guarantees. The documents shall schedule for each item the projected need dates for approval and procurement. At least 30 days shall be allowed after receipt of submittals by the Government for review and approval. If a submittal is returned less than acceptable, at least 14 days shall be allowed for review of subsequent re-submittals. The Contractor's Quality Control representative shall review the listing at least every 30 days and shall take appropriate action to maintain an effective system. Submittal of the document will not relieve the Contractor of the obligation to comply with all specification requirements for the

scheduled items. On sample items that are required for material and/or where the items shall be sent for selection, will be furnished the Contractor. Omissions from the attached sample submittal register shall not relieve the Contractor from providing all required submittals. In addition to those items listed on ENG Form 4288, the Contractor shall furnish submittals for all deviations from the drawings and specifications. The Contractor shall supply five copies of all items submitted.

1.4.1 Shop Drawings. Shop drawings shall be submitted for all fabricated components. Shop drawings are not required to be in CAD format, and may be based on the contract drawings, provided that the contractor's title block (including cognizant engineer's name and date) is substituted. Shop drawings shall include all dimensions, tolerances, material (alloy) callouts, and any other required fabrication and assembly instructions. Any additional fabrication instructions beyond those shown on the contract drawings shall also be included on the shop drawings. Any shop drawing items that are different than specified on the contract drawings shall not be incorporated unless specifically approved by the Government and shall be clearly indicated on the shop drawings.

1.4.2 Bill of Materials. Submit bill of materials for items furnished to include: quantities, item names/part numbers, alloys / materials, manufacturer (if applicable), and unit weights.

1.4.3 Materials Data. The Contractor shall submit copies of all purchase and mill orders for the metals used in this contract. Data shall include sizes of raw materials, quantities, complete alloy(ASTM) designations, and dates of purchase. The Contractor shall submit a list designating the material to be used for each chain item. Include signed/dated mill's certification that the alloys furnished meet the ASTM specifications required by this contract. Mill test documentation shall contain the name/address/date of any QC testing agencies.

1.4.4 Ultrasonic Testing Agency. The Contractor shall submit for approval the name of the testing agency, names of individuals qualified and proposed to perform the ultrasonic examination of the chain components, and copy record of ASNT-SNT-TC-1A certifications for those individuals.

1.4.5 Ultrasonic Test Reports. Testing reports shall include reportable indications, geometry of indications, location of indications, test parameters, and date of testing. The size, shape, and location of indications shall be characterized using sketches. The test report shall include all relevant information as required by ASTM E114.

1.4.6 Ultrasonic Testing Procedures. The Contractor shall submit ultrasonic testing procedures formulated by the NDT agency that includes description of the testing apparatus and governing ASTM specifications. This submittal shall contain information that demonstrates the defect threshold of 0.2 inch inclusions will be located and identified through the testing procedures.

1.4.7 Retaining Rings. Submit retaining ring (Mk 55/5-17) manufacturer's catalog and engineering data to demonstrate that it meets the specified criteria for composition and strength properties. Submit manufacturer's data including ring dimensions, installation instructions, and recommended ring groove dimensions.

1.4.8 Packaging. The contractor shall submit a detail showing construction of pallets for shipping and handling of chain assemblies and parts furnished unassembled. The submittal shall show the size and location of forklift slots on pallets and method of attaching lifting slings to the pallets. Proposed methods for wrapping and securing the chains to the pallets shall be shown.

1.4.9 QA/QC Logbook. Submit a complete copy of the QA/QC logbook immediately after completion of the specified QA/QC procedures and before delivery of the completed parts.

1.5 QUALITY ASSURANCE.

1.5.1 General. The Contractor is responsible to perform all specified quality control inspections and tests. The Contractor shall implement and maintain an inspection log to include copies of all descriptive data for all specified inspections and tests. The inspection log shall be made available immediately to the Government's inspector upon request. A complete copy of the inspection log shall be submitted to the Government at the end of specified inspections and tests. The Government reserves the right to witness any and all specified QC/QA procedures. The Contractor shall provide the Government with one-week advance notice of QC/QA procedure scheduling to allow time for witness coordination. All costs for specified QA/QC procedures and all costs for replacement of rejected parts shall be borne by the Contractor. Replacements for all rejected parts shall be 100% tested as specified herein for the original lots.

1.5.1.1 NDT Agency Requirements. The ultrasonic examination shall be conducted by a testing agency adequately equipped and competent to perform such services or by the Contractor using suitable equipment and qualified personnel. In either case, written approval of the examination procedures will be required and the

examination tests shall be made in the presence of the Contracting Officer's representative. Persons performing the ultrasonic examination shall be qualified for the specific procedure used in accordance with the current edition of ASNT SNT-TC-IA. Only individuals qualified for NDT Level II may perform this ultrasonic examination.

1.5.1.2 Non-Destructive Testing (NDT) for Flaws. A quantity representing approximately five percent (5%) of the total supplied quantity of sidebars and pins shall be ultrasonically scanned for internal defects as specified. The minimum quantities to be tested are shown in TABLE 1, below. Lots from which examined specimen parts are selected shall consist of at least 25% of the total quantity of each type part to be furnished. A lot shall be the completed components of a given type available at the inspection site. Parts to be examined shall be selected at random by a representative of the Contracting Officer. The Contractor shall notify the Government one week prior to when the lots are available for specimen selection. Flawed specimens (excessive inclusion size, out-of-tolerance dimension or hardness, or excessive surface roughness) will be subject to rejection.

1.5.1.2.1 Sidebar Tests. Sidebars shall be tested in the machined and hardened state. Sidebars shall be ultrasonically examined in accordance with ASTM A578 and ASTM E114 as approved. Specimens with inclusion (defect) size greater than 0.20 inch in any direction shall be rejected.

1.5.1.2.2 Pin Tests. Pins shall be tested in the machined and hardened state. Tested pins shall have ends finished to 125 micro-inches or smoother to allow axial direction ultrasound scans. Pins shall be ultrasonically examined in accordance with ASTM A578 and ASTM E114 as approved. Specimens with inclusion (defect) size greater than 0.20 inch in any direction shall be rejected.

1.5.2 Quality Assurance Measurements. Inspections to supplement the Contractor Quality Control NDT will be conducted by the Contractor in the presence of the Contracting Officer's representative. This testing will be to verify that dimensions, hardness and finish are within required tolerances. This testing of the chain components shall be performed at the Contractor's fabrication site.

Quantities subject to this testing are specified in Table 1. Parts to be examined will be selected at random by a representative of the Contracting Officer. Lots from which inspected parts are selected shall consist of at least 25% of the total quantity of each type part to be furnished. A lot shall be the completed components of a given type available at the inspection site. The

Contractor shall notify the Government one week prior to when the lots are available for specimen selection and inspection. More than one testing date may be required.

TABLE 1. QUALITY ASSURANCE TESTING

ITEM	MEASURED AND RECORDED PARAMETERS[1]	NUMBER OF SPECIMENS TESTED[3]
Long Pin 55/9-1[2]	OD,BHN,FINISH,UST	2
Normal Pin#1 55/9-5[2]	OD,BHN,FINISH,UST	13
Normal Pin#2 55/9-6[2]	OD,BHN,FINISH,UST	1
Normal Pin#3 55/9-7[2]	OD,BHN,FINISH,UST	1
Spacer Sleeve 55/9-2[2]	ID,OD,BHN,WIDTH,FINISH	15
Collar 55/9-8[2]	ID,OD,BHN,WIDTH,FINISH	29
Sidebar 55/9-9[4]	ID,PITCH,WIDTH,ID FINISH, SIDE FINISH,UST	69
Spacer Washer 55/9-15[2]	ID,WIDTH	1
Link Plate 55/9-11[2]	ID,WIDTH	1

NOTES:
1. OD = Outside Diameter, ID = Inside Diameter, BHN = Brinell Hardness Number, FINISH = Surface Finish UST = Ultrasonic Scan Test
2. Take two (2) measurements per parameter per specimen.
3. Test specimen quantities shown are at least 5% of the total quantity furnished.
4. Measure inside diameters of both bores and take one (1) measurement per bore. Measure pitch tolerance derived from sidebar inside diameter edge to edge measurements. Take two (2) hardness readings per specimen. Take two (2)width measurements per specimen.

1.5.2.1 Acceptance. All readings taken from the samples are required to be within the specified limits. Failure of any part to meet these contract requirements will be cause for rejection of the entire quantity until action is taken by the Contractor to correct defects and prevent recurrence and such actions have been approved by the Contracting Officer. Retesting will be subject to the same random sampling and testing procedures as the original lots.

1.5.2.2 Gages shall be made available at the Contractor's fabrication site, by the Contractor, to the Government for use in checking critical dimensions. Gages shall be vernier, micrometer, or snap type. Gages are required to measure the following:

(1) Side-bar, inside diameter of bore (ID).
(2) Pin diameter.
(3) Side bar pitch (gage to measure pitch with minimum/maximum tolerance of bore and link pitch).

(4) Gar S22 Surface Finish Comparator (see Par.3.4).

1.6 MEASUREMENT AND PAYMENT. The work of this Section shall be measured for payment by all of the lifting chain assemblies and spare parts delivered and accepted. Payments to the Contractor will not be made for material or equipment that does not comply with the contract requirements. The required quantities of components and spare parts are defined on the Bill of Materials.

1.6.1 Dam Gate Chain Assemblies will be measured for payment by each chain complete and delivered.

1.6.2 Lock Gate Chain Assemblies will be measured for payment by each chain complete and delivered.

1.6.3 Spare Parts will not be measured for payment. Payment will be made on a lump sum basis, complete and delivered.

PART 2 - PRODUCTS

2.1 METALS. Substitution of similar but not identical alloys to those specified will not be acceptable, as only the specified alloy combination is known to provide acceptable bearing performance in this application. Unless approved otherwise, all of a given specified alloy shall be the product of one manufacturer.

2.1.1 Normal Pins and Long Pins. These items shall be fabricated from ASTM A564 Type XM-25, Condition H1050 stainless steel. This material shall be certified by the steel manufacturer to provide at least 135000 psi minimum yield strength as defined by ASTM A564. Heat treatment shall be performed by the mill that supplies the alloy in accordance with the relevant ASTM heat treatment instructions.

2.1.2 Spacer Sleeves, Collars, Sidebars, Spacer Washers. These items shall be fabricated from heat treated ASTM B505 aluminum bronze conforming to UNS No. C95500 HT. This material shall be certified by the aluminum bronze manufacturer to provide 62000 psi minimum yield strength as defined by ASTM B505. Heat treatment shall be performed by the mill that supplies the alloy in accordance with the relevant ASTM heat treatment instructions.

2.1.3 Retaining Rings. Retaining rings shall be multiple-turn stainless steel construction and similar to Smalley model WST-400-S02 series. Thrust yield strength of the retaining rings shall be 150000 lbs minimum, when installed in the recommended groove detail. Retaining rings shall have offset permanently set into the

ring spiral to provide parallel flat sides butting the groove walls. Details of the retaining ring grooves shall be in accordance with the retaining ring manufacturer's requirements and recommendations. The pin groove dimensions shown on the contract drawings follow those recommended by Smalley for the appropriate ring size and the Contractor is responsible to make the appropriate pin detail changes for any other approved retaining ring used.

PART 3 - EXECUTION

3.1 WORKMANSHIP. Workmanship shall be of the highest grade and in accordance with the best modern practices to conform with the contract requirements.

3.1.1 Manufacturing Methods. The contract drawings only indicate dimensional and material characteristics of the chain components and finished assembly. The Contractor shall be responsible for the proper selection of manufacturing methods and assembly. The Contractor shall notify the Contracting Officer of conflicts within 30 calendar days after receipt of contract notice to proceed. The Contractor must receive written resolution before proceeding with the contract work.

3.2 FABRICATION.

3.2.1 General. All fabrication methods (such as flame cutting, shearing, boring, etc.) shall be stated on the submitted shop drawings for approval. All heat treatments or other preparations required to obtain the specified alloy properties shall be done before fabrication at the mill facility by the material supplier.

3.2.2 Chain Sidebars. Chain sidebars shall be cut from mill stock plate or bar stock. Chain sidebars may be cut by mechanically guided or hand guided torches provided the specified surface finish and profile is obtained. Reductions of required cross-section areas due to defects or bad machining workmanship are not acceptable

3.3 MACHINE WORK.

3.3.1 General. Unless otherwise required, all tolerance allowances, and gages for metal fits between plain, non-threaded and cylindrical parts shall conform to ANSI B46.1.

3.3.1.1 Lathe work. Lathe centers on all pins are permissible. Details of the centers shall be included on submitted shop drawings for approval.

3.3.2 Finished Surfaces.

3.3.2.1 Required surface finish. Values of roughness height where required are arithmetical average deviations expressed in micro-inches. Required roughness is the maximum value and any lesser (smoother) value will be satisfactory. Compliance with required surface finish shall be determined by sense of feel and by visual inspection of the work compared to a GAR S-22 Surface Finish Comparator (McMaster Carr Part # 8555T12) or an equivalent visual inspection gage as approved. Flaws such as scratches, ridges, holes, peaks, cracks, or checks will be cause for rejection.

3.3.2.2 Non-specified surface finish. The type of finish shall be that which is most suitable for the particular surface and shall provide the class of fit required. Surface finish requirements in addition to those shown on the contract drawings may be implied by the specified NDT procedures.

3.4 CLEANING. After fabrication and prior to assembly, oil, paint, and other foreign substances shall be removed from surfaces.

3.5 ASSEMBLY. Pipe wrenches, cold chisels, or other tools likely to cause damage to the surfaces of chain parts shall not be used for the work of assembling and tightening parts.

3.6 PREPARATION FOR SHIPPING.

3.6.1 Marking and Labeling. The four chain assemblies for the two lock tainter gates (main lock and auxiliary lock) are identical (39 pins each assembly). The six chain assemblies for the three dam gates are identical (33 pins each assembly). The contractor shall fully assemble each of the chain assembly lengths except for the end pins. End pins (lock pin numbers 1 and 39, and dam pin numbers 1 and 33) and their respective subcomponents shall be shipped separately as specified. Each chain assembly shall be clearly marked for "lock" or "dam" installation. The chain assembly upper and lower ends shall be clearly marked so that there is no confusion in the field as to which end attaches to the reused chain shackle (Mk 55/9-13) and which end lies upon the chain sprocket. Markings shall consist of durable and weatherproof tags indelibly and legibly marked and wired to the respective ends of the assemblies

3.6.2 Protection and Packaging of Finished Work. Chain components shall be assembled at the contractor's fabrication facility into the assembly lengths shown on the contract drawings before shipment. All machined surfaces and parts to be assembled shall be

thoroughly cleaned. Protective coatings, packing compounds, dirt, grit, and other foreign matter shall be removed before assembly. All finished surfaces shall be protected by suitable means. All pins and bores shall be lubricated with an anti-seize compound at assembly. The anti-seize compound shall contain copper, graphite and other metallic additives in a bearing lubricant. Each individual chain assembly shall be secured with steel banding to an individual forklift pallet and folded upon itself at pins so a crane can first pick the uppermost pin (highest pin number) and unfolds the chain assembly as it is hoisted. The pallet shall also be designed to rig to a 4-leg (or two loop) webbed sling for single point crane lift of the pallet/chain assembly as-shipped. The Contractor shall furnish the webbed sling(s) for hoisting the pallets and these slings shall become property of the Government. Spare parts shall be packaged in stackable hardwood forklift palletized crates suitable for shipping and long term storage. After assembly the new chain assemblies and parts shall at all times be stored up off the ground on the pallets and shall be covered with shrink wrap plastic or other means as approved to prevent washing-off the never seize onto surrounding surfaces.

Submittal Register Standard Form 4288-f:

Submittal Register Form 4288 to be completed and submitted by the Contractor is included as the PDF format filename: en4288-rfillin.PDF. This submittal register form may also be accessed by the Contractor at the following web location: http://www.usace.army.mil/inet/usace-docs/forms/engforms.htm